

CLAIMS

What is claimed:

- 1 1. A method for dynamically controlling cooling resources in a data center
2 comprising:
3 determining a workload within the data center;
4 determining an amount of heat being generated as a function of the workload; and
5 activating each of a plurality of different types of cooling resources within the
6 data center in an optimal fashion based on the heat being generated.
- 1 2. The method of claim 1 wherein the optimal fashion is based on a cost associated
2 with the activation of each of the plurality of different cooling resources.
- 1 3. The method of claim 1 wherein the method further comprises:
2 deactivating one or more of the activated plurality of different types of cooling
3 resources within the data center based on a reduction in the amount of power being
4 consumed by the workload.
- 1 4. The method of claim 1 wherein the amount of heat being generated is a function
2 of an amount of power being consumed by the data center.
- 1 5. The method of claim 4 wherein each of the plurality of cooling resources has a
2 cooling capability wherein the cooling capability is a function of an amount of heat that
3 can be removed by the cooling resource and the act of activating each of a plurality of
4 different cooling resources in an optimal fashion further comprises:
5 activating each of a plurality of different cooling resources based on the amount
6 of heat that can be removed by each of the plurality of cooling resources.
- 1 6. The method of claim 1 wherein the plurality of cooling resources comprises an
2 air-based cooling resource, a liquid-based cooling resource and a gas-based cooling
3 resource.
- 1 7. The method of claim 6 wherein the act of activating each of a plurality of

2 different cooling resources within the data center in an optimal fashion further
3 comprises:
4 activating the air-based cooling resource before the liquid-based cooling resource
5 and the gas-based cooling resource; and
6 activating the liquid-based cooling resource before the gas-based cooling
7 resource.

1 8. A system for dynamically controlling cooling resources in a data center
2 comprising:
3 means for determining a workload within the data center;
4 means for determining an amount of heat being generated as a function of the
5 workload; and
6 means for activating each of a plurality of different types of cooling resources
7 coupled within the data center in an optimal fashion based on the amount of heat being
8 generated.

1 9. The system of claim 8 wherein the method further comprises:
2 means for deactivating one or more of the activated plurality of different types of
3 cooling resources within the data center based on a reduction in the amount of heat being
4 generated.

1 10. The system of claim 8 wherein the amount of heat being generated is a function
2 of an amount of power being consumed by the data center.

1 11. The system of claim 10 wherein each of the plurality of cooling resources has a
2 cooling capability wherein the cooling capability is a function of an amount of heat that
3 can be removed by the cooling resource and the means for activating each of a plurality
4 of different cooling resources in an optimal fashion further comprises:
5 means for activating each of a plurality of different cooling resources based on
6 the amount of heat that can be removed by each of the plurality of cooling resources.

1 12. The system of claim 11 wherein the plurality of cooling resources comprises an

2 air-based cooling resource, a liquid-based cooling resource and a gas-based cooling
3 resource.

1 13. The system of claim 12 wherein the means for activating each of a plurality of
2 different cooling resources within the data center in an optimal fashion further
3 comprises:

4 means for activating the air based cooling resource before the liquid based
5 cooling resource and the gas based cooling resource; and

6 means for activating the liquid based cooling resource before the gas based
7 cooling resource.

1 14. A data center comprising:

2 a global computer system;

3 a plurality of different cooling resources coupled to the global computer system;

4 and

5 a cooling resource control module coupled to the global computer system and the
6 plurality of different cooling resources wherein the cooling resource control module
7 includes logic for:

8 determining a workload within the global computer system;

9 determining an amount of heat being generated as a function of the
10 workload; and

11 activating each of a plurality of different types of cooling resources
12 coupled to the global computer system in an optimal fashion based on the amount of heat
13 being generated .

1 15. The data center of claim 14 wherein the optimal fashion is based on a cost
2 associated with the activation of each of the plurality of different cooling resources.

1 16. The data center of claim 14 wherein cooling resource control module further
2 comprises logic for:

3 deactivating one or more of the activated plurality of different types of cooling
4 resources within the data center based on a reduction in the amount of heat being

5 generated.

1 17. The data center of claim 14 wherein an amount of heat being dissipated by the
2 global computer system is a function of an amount of power being consumed by the
3 global computer system.

1 18. The data center of claim 17 wherein each of the plurality of cooling resources has
2 a cooling capability wherein the cooling capability is a function of an amount of heat that
3 can be removed by the cooling resource and the logic for activating each of a plurality of
4 different cooling resources in an optimal fashion further comprises logic for:

5 activating each of a plurality of different cooling resources based on the amount
6 of heat that can be removed by each of the plurality of cooling resources.

1 19. The data center of claim 14 wherein the plurality of cooling resources comprises
2 an air-based cooling resource, a liquid-based cooling resource and a gas-based cooling
3 resource.

1 20. The data center of claim 19 wherein the logic for activating each of a plurality of
2 different cooling resources coupled to the global computer system in an optimal fashion
3 further comprises logic for:

4 activating the air based cooling resource before the liquid based cooling resource
5 and the gas based cooling resource; and

6 activating the liquid based cooling resource before the gas based cooling
7 resource.

1 21. A computer program product for dynamically controlling cooling resources in a
2 global computer system, the computer program product comprising a computer usable
3 medium having computer readable program means for causing a computer to perform the
4 steps of:

5 determining a workload within the global computer system;

6 determining an amount of heat being generated as a function of the workload; and

7 activating each of a plurality of different types of cooling resources coupled to the

8 global computer system in an optimal fashion based on the amount of heat being generated.

1 22. The computer program product of claim 21 wherein the optimal fashion is based
2 on a cost associated with the activation of each of the plurality of different cooling
3 resources.

1 23. The computer program product of claim 21 further comprising means for causing
2 a computer to perform the step of:
3 deactivating one or more of the activated plurality of different types of cooling
4 resources within the data center based on a reduction in the amount of heat being
5 generated.

1 24. The computer program product of claim 21 wherein the plurality of cooling
2 resources comprises an air-based cooling resource, a liquid-based cooling resource and a
3 gas-based cooling resource.

1 25. The computer program product of claim 19 wherein the step of activating each of
2 a plurality of different cooling resources coupled to the global computer system in an
3 optimal fashion further comprises:
4 activating the air-based cooling resource before the liquid-based cooling resource
5 and the gas-based cooling resource; and
6 activating the liquid-based cooling resource before the gas-based cooling
7 resource.

1 26. A cooling resource control module for a data center comprising:
2 determination logic for:
3 determining a workload within the data center; and
4 determining an amount of heat being generated as a function of the
5 workload; and
6 activation logic for activating each of a plurality of different types of cooling
7 resources within the data center in an optimal fashion based on the amount of heat being
8 generated.

1 27. The cooling resource control module of claim 26 further comprising logic for:
2 deactivating one or more of the activated plurality of different types of cooling
3 resources within the data center based on a reduction in the amount of heat being
4 generated.

1 28. The cooling resource control module of claim 26 wherein the plurality of
2 different types of cooling resources comprise an air-based cooling resource, a liquid-
3 based cooling resource and a gas-based cooling resource.

1 29. The cooling resource control module of claim 28 wherein the logic for activating
2 each of a plurality of different types of cooling resources within the data center in an
3 optimal fashion further comprises logic for:
4 activating the air-based cooling resource before the liquid-based cooling resource
5 and the gas-based cooling resource; and
6 activating the liquid-based cooling resource before the gas-based cooling
7 resource.